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(54) **HIGH EFFICIENCY APPARATUS FOR
TREATING NITROGEN AND
PHOSPHOROUS CONTAINED IN SEWAGE**

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patent shall be extended for 0 days.

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210/906

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210/195.1, 903

(56) **References Cited**

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(57) **ABSTRACT**

Disclosed herein is a high efficiency apparatus for treating
nitrogen and phosphorous in sewage. The apparatus includes
a sludge denitrification tank supplying sludge to an anaero-
bic tank.

1 Claim, 1 Drawing Sheet

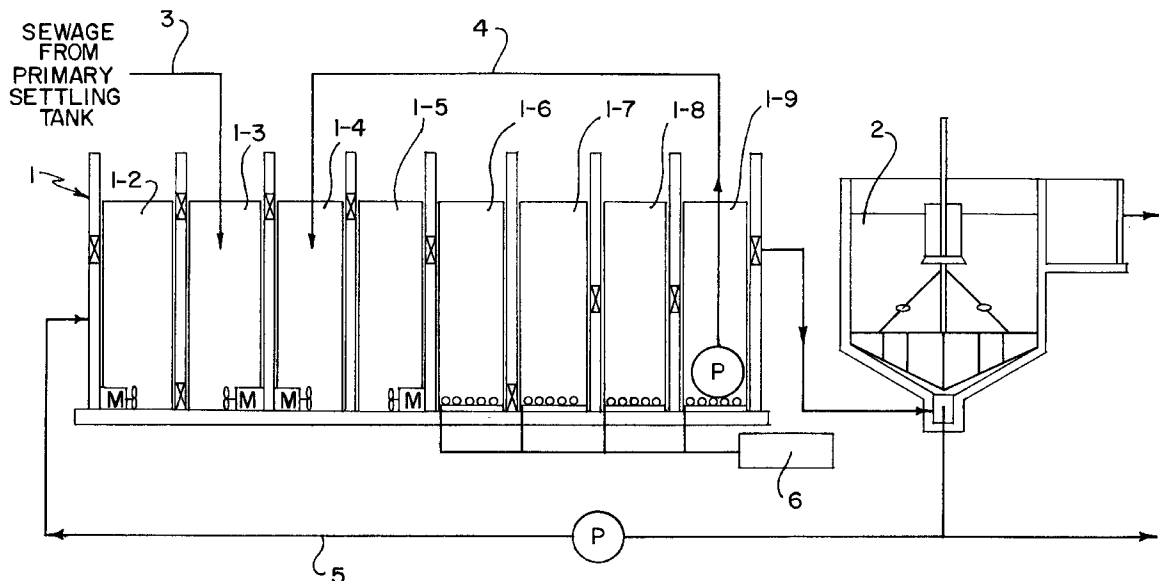
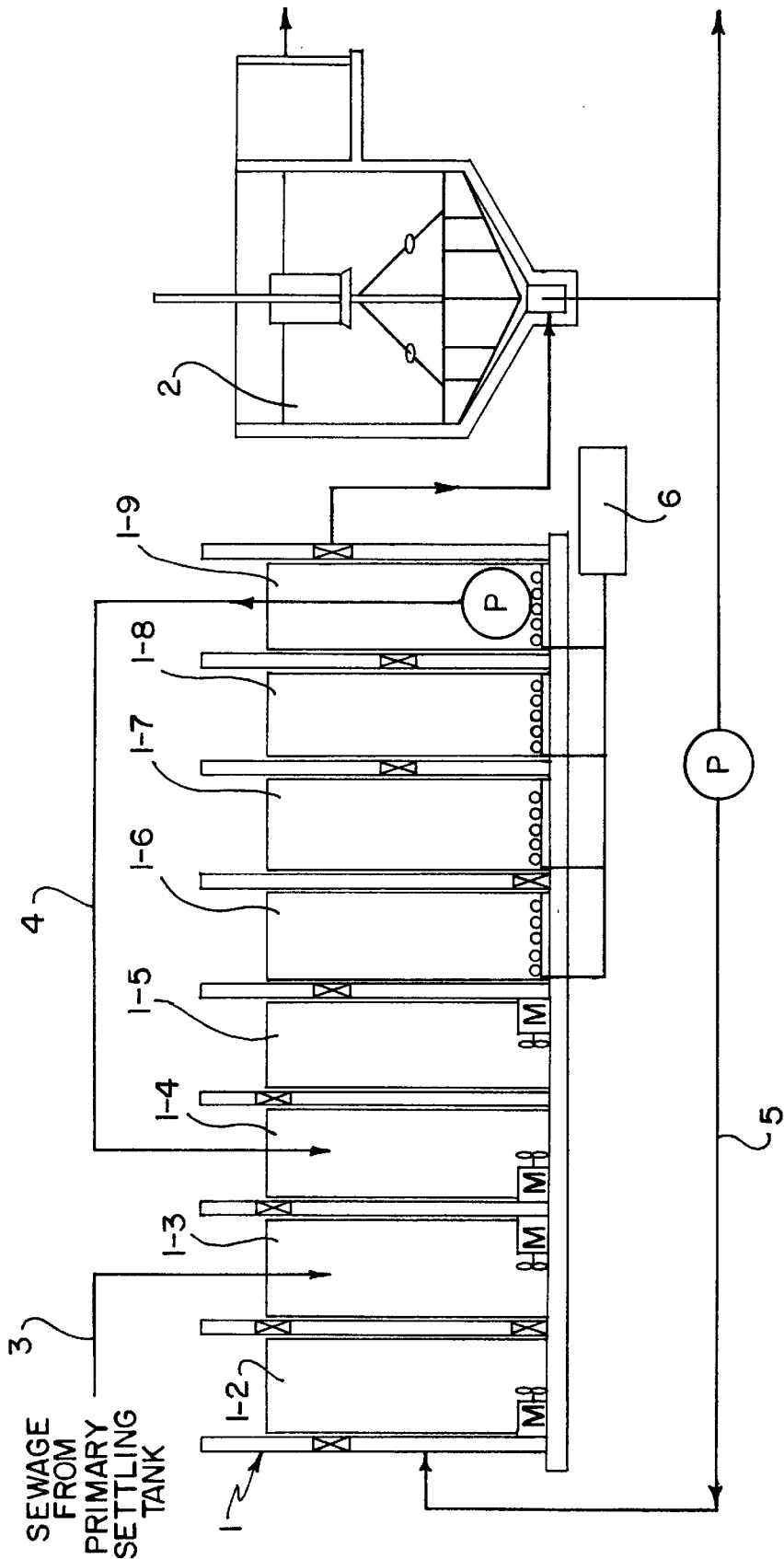


FIG. 1



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HIGH EFFICIENCY APPARATUS FOR TREATING NITROGEN AND PHOSPHOROUS CONTAINED IN SEWAGE

This application is a continuation-in-part of application
Ser. No. 08/843,738, filed Apr. 21, 1997, abandoned.

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates, in general, to a sewage
treatment apparatus for purifying wastewater such as sewage
and, more particularly, to a high efficiency apparatus for
treating nitrogen and phosphorus contained in sewage in
case of very low concentration of substrate contained in
influent.

2. Description of the Prior Art

In a conventional sewage treatment apparatus, it is impos-
sible to obtain a condition suitable for sewage treatment
when sewage is low in concentration or temperature. As a
result, loss of sludge occurs in an anaerobic tank equipped
in such a conventional sewage treatment apparatus. In
addition, the conventional sewage treatment apparatus is
typically configured to directly introduce wastewater into
the anaerobic tank. However, this configuration accelerates
the sludge wash-out in the anaerobic tank, which lowers the
removal efficiency of nitrogen and phosphorus.

SUMMARY OF THE INVENTION

Therefore, it is an objective of the present invention to
overcome the problems encountered in prior arts and to
provide a high efficiency apparatus for treating nitrogen and
phosphorus contained in sewage, which can prevent sludge
wash-out by steadily providing sludge to a sludge denitri-
fication tank which, then, serves as a sludge reservoir to
remove nitrate nitrogen of return sludge by endogeneous
denitrification.

Based on the intensive and thorough research by the
present inventor, the above objective could be accomplished
by a provision of a high efficiency apparatus for treating
nitrogen and phosphorus contained in sewage, comprising:
a treating tank including a sludge denitrification tank, an
anaerobic tanks, a plurality of anoxic tanks and a plurality of
aerobic tanks which communicate sequentially with one
another; a final settling tank for storing sewage fed from the
last aerobic tank; a sewage influent unit arranged between a
primary settling tank and the anaerobic tank; an internal
recycle unit for denitrifying nitrated materials, the internal
recycle unit being arranged between the last aerobic tank
and the last one of the anoxic tanks; and a sludge returning
unit arranged between the final settling tank and the sludge
denitrification tank.

BRIEF DESCRIPTION OF THE DRAWINGS

Other objects and aspects of the invention will become
apparent from the following description of embodiments
with reference to the accompanying drawing in which:

FIG. 1 is a schematic view illustrating a high efficiency
apparatus for treating nitrogen and phosphorus contained
sewage in accordance with the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

The application of the preferred embodiment of the
present invention is best understood with reference to the
accompanying drawing.

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Referring to FIG. 1, there is a high efficiency apparatus for
treating nitrogen and phosphorus contained in sewage in
accordance to the present invention

As shown in FIG. 1, the apparatus includes a treating tank
1 consisting of a sludge denitrification tank 1-2, an anaerobic
tank 1-3, two anoxic tanks 1-4 and 1-5 and four aerobic
tanks 1-6, 1-7, 1-8 and 1-9 which are linearly arranged, in
order. But according to the requirements degree of nitrogen
and phosphorus or situation of sewage treatment plant, it is
required to modify the number of anaerobic tanks, anoxic
tanks and aerobic tanks.

In addition to the treating tank 1, the apparatus also
includes a final settling, tank 2.

In order to feed sewage from a primary settling tank (not
shown) to the anaerobic tank 1-3, a sewage influent unit 3 is
connected between the primary settling tank and the anaero-
bic tank 1-3. An internal recycle, unit 4, is arranged between
the last aerobic tank 1-9 and the primary anoxic tank 1-4 in
order for denitrification of nitrated sewage. A sludge return-
ing unit 5 is also arranged between the final settling tank 2
and the sludge denitrification tank 1-2 for returning sludge.
In FIG. 1, the reference numeral "6" represents a blower.

A description will now be given of the procedure of
treating sewage, based on the above arrangement according
to the present invention.

First, sewage from the primary settling tank (not shown)
where substrate and floating materials are partially removed
is introduced through the sewage influent, unit 3, to the
anaerobic tank 1-3.

Whereas, sludge from the final settling tank 2 is fed to the
sludge denitrification tank 1-2 by the sludge returning unit 5.
Accordingly, a stable supply of sludge is accomplished
which is necessary for effective endogeneous denitrification.
As a result, a suitable condition for denitrification is
acquired in the sludge denitrification tank 1-2. A reaction for
release of phosphorus is also effectively carried out by virtue
of substrate contained in the sewage which is introduced
through the sewage influent, unit 3, to the anaerobic tank
1-3. In the anoxic tanks 1-4 and 1-5, the sewage is utilized
to denitrify a nitrate mixture which is returned from the last
aerobic tank 1-9 to the nitrate mixture which is returned
from the last aerobic tank 1-9 to the primary anoxic tank 1-4
by internal recycle, unit 4. Thereafter, the denitrified sewage
thus obtained in a sequential manner by dissolved oxygen
which is supplied by blower 6. At this time, substrate still
remaining in the denitrified sewage are also oxidized. The
phosphorus components resulting from the release of phos-
phorus of sewage are absorbed into microorganisms while
passing through the aerobic tanks 1-6 to 1-9.

In addition, the sludge deposited on the bottom of the final
settling tank 2 returns to the sludge denitrification tank 1-2
by the sludge returning to unit 5. At this time, the treated
water is drained out from the final settling tank 2.

As described hereinbefore, the high efficiency apparatus
for treating nitrogen and phosphorus according to the
present invention is very advantageous in that not only are
microorganisms prevented from being lost upon the release
of phosphorus in the anaerobic tank, but a stable reaction
condition necessary for the release of phosphorus can be
acquired in the anaerobic tank 1-3 by returning the sewage
from the final settling tank to the sludge denitrification tank
1-2.

In accordance with the present invention, an embodiment
of the present apparatus was operated and the result thereof
was obtained as follows.

When the concentration of nitrate nitrogen in return
sludge was 6.0 mg/l, the sludge was introduced to the sludge

denitrification tank and the concentration of nitrate nitrogen was changed through the retention time.

Retention Time (hrs)	0	0.5	1.0	1.5	2.0	3.0
NO ₃ Concentration (mg/l)	6.0	5.1	3.8	2.9	2.4	2.2

On the basis of the above data, the NO₃ concentration could be lower to 2.9 mg/l or 2.4 mg/l from 6.0 mg/l at the retention time of 1.5 hrs or 2.0 0.025 NO₃ g/gMLVSS days.

When the sludge having a nitrate nitrogen concentration of 3 mg/l below was fed into the anaerobic tank and an influent of BOD 100 mg/l was introduced into the anaerobic tank, the release of phosphorus in the anaerobic tank was maximized.

The present invention has been described in an illustrative manner, and it is to be understood that the terminology used is intended to be in the nature of description rather than of limitation.

Many modification and variations of the present invention are possible in light of the above teachings. Therefore, it is to be understood that within the scope of the appended claims, the invention may be practiced rather than as specifically described.

What is claimed is:

- 1. A high efficiency apparatus for treating nitrogen and phosphorus contained in sewage, comprising;
 - a treating tank including an anaerobic tank, a plurality of anoxic tanks and a plurality of aerobic tanks which communicate sequentially with one another;
 - a final settling tank for storing sewage fed from the last aerobic tank;
 - a sewage influent unit arranged between a primary settling tank and said anaerobic tank to supply influent to said anaerobic tank;
 - an internal recycle unit for denitrifying nitrated materials arranged between the last of said plurality of said aerobic tanks and the last of said plurality of anoxic tanks; and
 - a sludge denitrification tank; and
 - a sludge returning unit arranged between said final settling tank and said sludge denitrification tank, said sludge denitrification tank supplying sludge having a nitrate nitrogen concentration of below 3 mg/l into said anaerobic tank.

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